DOCUMENT RESUME

ED 226 819 PS 013 316

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TITLE Ambiguity Detection and Questioning Skills: Two Instructional Strategies for Preadolescents.
PUB DATE Aug 82
NOTE 20p.; Paper presented at the Annual Meeting of the American Psychological Association (90th, Washington, DC, August 23-27, 1982).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Ambiguity; *Cognitive Ability; *Elementary School Students; Games; Grade 5; *Training
IDENTIFIERS *Analogies; *Questions; Uncertainty

ABSTRACT

A study was conducted to determine the best match between the ability of elementary school students to detect ambiguity and two instructional strategies: analogizing and practice. To identify subjects' initial abilities in detecting ambiguity, 57 participating fifth graders were administered a task similar to the Park-and-Shop board game. Interactions between each child and an experimenter were recorded and scored for detection of ambiguity and for the incidence of four types of questions in the child's responses. The two treatment conditions involved 2 days of small-group training for 45 minutes each day. In both conditions and on both days, subjects were read the same mystery story and asked if they could solve the mystery. Treatment in the analogizing condition on the first day consisted of group facilitation in recognizing uncertainty; on the second day the analogizing treatment involved (1) a display of the analogy "uncertainty is to mystery as question is to detection" and (2) a discussion of how detectives look for clues and ask questions when uncertain. In the practice condition on the first day, an array of different types of questions were displayed; children practiced by giving examples of questions. Practice on the second day consisted of a discussion focusing on questions adults ask that children don't like. Subsequently, all children were asked to respond to a six-item posttest questionnaire assessing their level of certainty about how effective their performance on the board game had been. Results are discussed. (RH)

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Ambiguity Detection and Questioning Skills: Two Instructional Strategies for Preadolescents

Paper presented at the
American Psychological Association
Washington, D.C.
August 1982

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Learning what to do with ambiguity is essential for progression towards effectively completing learning tasks and for successful social interactions. It is evident that a number of young listeners do not ask questions when given ambiguous messages (Alvy, 1968; Ironsmith & Whitehurst, 1978; Patterson & Kister, 1981) or appraise the message as being inadequate (Flavell, Botkin, Fry, Wright, & Jarvis, 1968; Asher, 1976; Bearison and Levey, 1977; Markman, 1977). Children who have poor communication skills do not test their understanding of new messages and may not try to make sense of ambiguities. When the decoder recognizes that there is some ambiguity in the message but fails to ask a question to gather the necessary information, he or she may fail at the task or withdraw from the situation. Sieber et al. (1978) noted that uncertainty about what to do with ambiguous information was posi-

tively related to elementary students' use of hard and soft drugs. It would be useful to supply all children with the requisite skills in asking questions when they are faced with academic or social uncertainty.

Prescriptive intervention approaches suggest that individual analyses of a person's communication strengths and weaknesses is critical in determining the most appropriate training program to meet an individual student's needs. Effectiveness of a program depends on its appropriateness for a specific person.

Training Children's Ambiguity Detection Ability. Studies using the referential communication paradigm have consistently found that communication of information between preschool children is often quite ineffective, and that accuracy of communication improves gradually over the elementary years (Glucksberg et al., 1975; Krauss & Glucksberg, 1969). While the general emphasis in referential communication literature has been on the speaker's role (Fry, 1966, 1969; Shantz and Wilson, 1972; Whitehurst, 1976; Whitehurst & Merkur, 1977), The utility of a training research strategy rests upon the careful specification of both speaking and listening skills.

Glucksberg and his colleagues (Glucksberg et al., 1975) remarked that there were at least three things that listeners could do that might improve communication performance:

1) They can judge or estimate their confidence or certainty of understanding. That is they can recognize ambiguity or noninformative messages as such. 2) If they recognize that

a message or communication is inadequate, they can make this known to the speaker. 3) Finally they can specify the additional information that is needed in order to clarify the message.

Ammon (1981) suggests that listening failures are due to a deficiency in mobilizing existing comparison skills. One study that attempted to facilitate children's performances in the listener role was reported by Cosgrove & Patterson (1977). A second study (Cosgrove & Patterson, 1978) explored the possibilities of modeling effective listener behavior as a technique for training young listeners, and also investigated the idea that instructions and modeling together might be more effective in facilitating listener performances than either method individually. Results showed that children who had received either instruction or modeling gave better listener performances than those in a no-training control condition. However, the two types of training together were no more effective than either type separately. Patterson and Kister (1981) suggest that there may be an "action deficit" - the children would know that a message was inadequate, but would not know what to do to reduce uncertainty. The Cosgrove and Patterson (1977) instructions suggested the nature of actions to be taken in these circumstances.

Patterson, Massad, and Cosgrove (1978) systematically varied the presence and absence of instructions about a plan to engage in comparison activities and a plan to request more information if the speaker's message was ambiguous ("action plan"). Children who received the action plan asked more

questions when messages were ambiguous and made more correct referent choices than other subjects even on a delayed test. These findings fail to support a comparison deficit interpretation of children's difficulties as listeners, but are clearly consistent with an action deficit hypothesis. Their results suggest that knowing when and how to request additional information from a speaker is an important listener skill that can be facilitated using brief procedures. The results of a recent study by Ironsmith and Whitehurst (1978) are also consistent with this conclusion.

In sum, it is necessary to teach children to ask questions when faced with uncertainty. It may also be useful to teach different strategies according to the child's ability to detect ambiguity or ask questions.

Instructional Strategies. Although some researchers have shown that rehearsal or practice can promote the assimilation of knowledge (Bower, 1974; Robinson, 1977; Yuille, 1973; McCauley & Kellas, 1974; McFarland & Kellas, 1975), other researchers conclude that rehearsal is largely a means of coordinating behavior and does not imprint associations (Aronfreed, 1969; Gewirtz, 1971a,b; Kennedy & Miller, 1976). The reason for these discrepant findings may be due to the types of knowledge associated with rehearsal or practice. Declarative knowledge is facts whereas procedural knowledge represents procedures (Rumelhart & Norman, 1981). The studies that suggest practice or rehearsal as favorable for the integration of knowledge have dealt primarily with declarative

knowledge (facts or rules) (Bower, 1974; Robinson, 1977; Yullie, 1973) or pairing images with linguistic connectors (McCauley & Kellas, 1974; McFarland & Kellas, 1975).

In the teaching of concepts (ie. detecting ambiguity), overt practice fares poorly when pitted against a procedure such as modeling. Kessler, White, Rosenthal, and Phibbs' study (cited by Rosenthal & Zimmerman, 1978) compared vicarious guidance with a variety of direct methods. Despite the complexity of the task, demonstrations were superior to all approaches based on direct practice.

If a learner understands the process involved in utilizing a procedure like analogizing, which maps newly acquired information on to his or her existing prior skills, then the child has a strategy for utilizing his or her experience. This is applicable to generating behavior from a process of abstract modeling (Bandura, 1971; Zimmerman & Rosenthal, 1974).

The present investigation seeks to find the best match between ability to detect ambiguity and two instructional strategies (analogizing vs. practice). The hypotheses under investigation are:

Hypothesis 1. Students low in ability to detect ambiguity will learn significantly better through modeling with analogizing than by practice.

Hypothesis 2. Students high in ability to detect ambiguity will learn equally with both analogizing and practice strategies.

Hypothesis 3. Students who recognize their own uncertainty (that they are confused) will score higher on ambiguity detection.

METHOD

Subjects. Subjects were 57 fifth graders from a Los Angeles School District. There were 33 males and 24 females ranging from 10.4 to 12.1 years of age.

Experimenters. Five graduate students and one undergraduate from two universities served as experimenters (E's). The experimenters basically matched the sex and racial constellation of the student population. Experimenter differences were controlled for by randomly assigning each experimenter's subjects to one of the three conditions. Also, subjects were initially randomly assigned to an experimenter. Each child saw the same experimenter twice, once at the pretest and once at the posttest.

Ambiguity Detection Task. The protocols developed for the assessment of ambiguity detection involved a set of 11 cards with instructions, a map displaying city blocks and streets, 2 example maps, colored pens, and audiocassettes. Each child was introduced to the task by the experimenter who told the subject that:

"We are developing a game similar to Park-and-Shop (a Milton-Bradley board game) for boys and girls your age. We would like to see how our directions work and you've been chosen to help us try out our new game. I'm going to give you

directions to different places to visit and I want you to mark the spot that I'm talking about. First, I'll show you how we play the game. You can follow the map for the first two turns."

The experimenter then demonstrated two examples to the child; one in which the interviewer pointed to pairs of stores and stated that it was important for the child to get to the designated place. The second example demonstrated the frame of reference of the map. The experimenter told the child to imagine that he or she was the person walking from the store or place. Then the E turned the map around so that he or she would be certain that the direction to turn left or right was seen from the perspective of where one would be on the map if the directions were followed. After the two examples the E asked the child if he or she understood how one plays the game. All students were given a chance to decide if they wanted to play. Everyone chose to participate and followed the E's directions for nine trials. The first trial was counted as a warm up and the third trial served as a set up for a later trial. Seven trials were counted in the ambiguity detection scale.

Scoring. For purposes of data analysis, verbal recordings of the children's responses to the E's directions were coded and scored for frequencies of ambiguity detection and question asking. The ambiguity detection scale consisted of seven targeted examples (six examples of inadequate information to make a choice between two equally plausible choices and one trial

with contradictory directions). In order to score a trial on ambiguity detection, the child had to explicitly ask the E which referent was intended. Internal consistency coefficients for the seven items were .71 for the pretest and .70 for the posttest.

Questions asked at other points were scored in four categories. INFORMATION questions basically were procedural questions such as, "Do I turn right?", "Where is the park?", "To which street?" These questions were used to obtain more information from the E. ECHO questions simply repeated what the E just said using an inflection, for example, "Turn right on East Street?". ACKNOWLEDGE questions were used to seek feedback on the chosen referent or acknowledgment of the response. These were after the fact questions where the child did not solicit for more information in making his or her choice but marked a spot before inquiring, "Is this the right one?" SPONTANEOUS questions either globally asked for procedural advise for the entire task ("What else do I do?"), or presented an irrelevant question for detecting ambiguity ("What other class is going to take this?, "What is the tape recorder for?", "Should I take another colored pen?").

Frequencies of how many times the child confused left and right and how many times they were distracted by street labels (the word East Street versus the actual street) were also coded.

Treatment. Training consisted of 2 45-minute sessions in groups of 8-10. The differential size is due to absenteeism from school on either day of the treatment. Four subjects had to be dropped from the study. Two graduate students (other than the students involved as experimenters) simultaneously taught the question asking skills. Each of the instructors taught the same treatment to two consecutive groups.

On Day 1 and Day 2 both treatments had the same mystery story from a popular children's book read to them. After the story both instructors asked the group if they could solve the mystery. Instructional strategies varied for the remainder of the sessions.

Analogizing. Day 1. The instructor facilitated the group in recognizing uncertainty (knowing for sure). She asked the subjects if they could draw from their prior experience and think about a time when they had been confused before. Everyone got a chance to tell about their experience in a round-robin. Day 2. Students were asked if they remembered their experience of being uncertain or confused. Before the story was read the instructor suggested that they think about being a detective. Everyone picked a name of a famous detective and tried to imagine how a detective would solve a mystery. After the story the analogizing strategy was set up displaying the analogy UNCERTAINTY:MYSTERY;QUESTION:DETECTION and discussing how detectives look for clues and ask questions when they are uncertain. Then they discussed how the character in the story solves new mysteries each time.

Practice. Day 1. The instructor facilitated the group in giving examples of questions by displaying a poster with an array of different types of questions (who, what, where, how, why, when, which). Everyone got a chance to practice by giving examples of questions in a round robin. Day 2. Students were asked if they remembered the different types of questions. Before the story was read the instructor suggested that they think about questions they would ask to solve the case. After the story the didactic session consisted of a discussion on questions adults ask that kids don't like. This time they named the unfavorable questions. For example: "What grade are you in?", "Do you like school?", "Aren't you glad it's almost summer?"

Questionnaire. After the post ambiguity detection task, all children were asked to respond to six items. These items tapped children's attitudes about the task they just completed. Two items labeled FUN and OTHERLIKE indicated the child's enjoyment of the "game". Two items labeled CONFUSED and HOWSURE indicated a measure of uncertainty or how successful they believed they were in accomplishing the task (arriving at the correct destination). The other two items (ie. HOWFIND) were used to assess what type of strategy the child employed in the task. Subjects in both treatment conditions were also asked what they learned.

RESULTS

Aptitude-Treatment Interaction. The first two hypotheses suggest an interaction between the aptitude (ambiguity detection) and the treatment (analogizing vs. practice). While initial ability to detect ambiguity accounted for 72% of the variance in the regression of treatment and aptitude on the dependent variable, ambiguity detection, neither treatment nor the interaction were significant. Although the hypotheses were not confirmed, the regression of the aptitude x treatment effect on ambiguity detection approached significance. Correlations between pretest ambiguity detection and posttest ambiguity detection for each of the three groups are: .48 for analogizing; .82 for practice; and .81 for controls. In effect there was a differential relationship within high and low ability in the analogizing condition, but not in the practice condition or in the control group.

Uncertainty. Analysis of variance procedures revealed a significant main effect of confused or not on ambiguity detection. Children who were confused (n=28) had a mean score of 1.6 on ambiguity detection while children who said they were not confused (n=26) had a mean score of 3.3 ($F(1,52)=12.59$, $p < .001$).

Categories of Questions. In looking at the construct "ambiguity detection" this investigation also looked at the relationship of ambiguity detection to other types of questions. Correlations between the four categories of questions

and ambiguity detection questions are listed in Tables 1 and 2.

Insert Tables 1 and 2 here

Initial Ability. Ambiguity detection had a significant positive correlation to INFORMATION questions (.40, $p < .01$). Asking for more information is positively related to initial ability to detect ambiguity. ECHO, ACKNOWLEDGEMENT, and SPONTANEOUS questions had no significant relationship to ambiguity detection. INFORMATION questions had a positive correlation to ACKNOWLEDGEMENT and to SPONTANEOUS questions (See Table 1). Preadolescents who ask for more information generally ask for more feedback and for more irrelevant details. The underlying need to satisfy their uncertainty may prompt some students to seek more information. Although the correlations are low, SPONTANEOUS questions significantly related to the three other types of questions. This may indicate that children with general skill in asking questions ask for additional information, repeat directions, and try to solicit feedback, but do not necessarily detect ambiguity while doing this.

There was a significant inverse relationship (-.44, $p < .01$) between ambiguity detection and mixing left and right on the map. It is apparent that children who had a more difficult time perceiving frame of reference on the map were having

a more difficult time detecting ambiguity. There were no significant differences between conditions in regard to whether children mixed left and right.

Posttest. After training there is a change in the relationships within types of questions to each other. ECHO and ACKNOWLEDGEMENT questions no longer relate to each other or to SPONTANEOUS questions. INFORMATION questions relate positively to ECHO questions (See Table 2). One could speculate that children are now focusing more on the task of arriving at the correct destination and asking the Experimenter to repeat the directions than they were previously. Children may believe that the Experimenter is giving the correct directions, hence they ask for repetitions rather than comparing the information they have received with what they need.

Enjoyment vs. Task. Comparing children's ambiguity detection responses to their perceptions of others liking this task, it was found that children who did not think others would like this task scored significantly higher ($\bar{X}$ = 3.9, n=9) than those who believed others would enjoy this task ($\bar{X}$ = 2.1, n=47) ($F(1,54) = 6.98$, $p < .01$). The relationship between others liking the task and enjoying it themselves was positive (.33, $p < .05$) as could be expected.

An ANOVA with fun by learning was significant ($F(3,32) = 8.89$, $p < .001$). Of the 36 students in the two training conditions, 33 said the game was fun. The three who did not enjoy the task also said they didn't learn anything.

DISCUSSION

The findings of this study show that: 1) most children have had prior experience with asking questions even if they do not detect ambiguity; and 2) children who recognize their uncertainty are better ambiguity detectors. What educators need to do is to find the most efficient instructional method for mobilizing the children to resolve their uncertainty when faced with ambiguous text or stimuli. Although we can not promise that children will avoid frustrations with difficult material, we can supply them with strategies for using their skills when they encounter ambiguity. Teaching children a strategy such as analogizing would be efficient because analogizing aids the child in drawing upon their prior experiences and/or skills. Practice may be a viable alternative to teaching children how to ask questions, but it does not teach them when to ask.

One could not conclude from this study that analogizing is a better instructional strategy than practice in teaching question asking skills. Future directions in this line of research need to take into account the child's ambiguity detection ability level and match that ability level with an instructional strategy. Increasing the sample size may be necessary to adequately test the aptitude-treatment-interaction approach.

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TABLE 1

Correlations between Initial Ambiguity Detection Ability and Other Categories of Questions

	DETECTION	INFORMATION	ECHO	ACKNOWLEDGE	SPONTANEOUS
DETECTION		.40**	.11	.01	.08
INFORMATION			.16	.43**	.36**
ECHO				.27*	.28*
ACKNOWLEDGE					.28*
SPONTANEOUS					

N=57 $R < .05$* $R < .01$**

TABLE 2

Correlations between Post Ambiguity Detection Ability and Other Categories of Questions

	DETECTION	INFORMATION	ECHO	ACKNOWLEDGE	SPONTANEOUS
DETECTION		.25*	.00	.05	.09
INFORMATION			.35**	.12	.30*
ECHO				.12	.03
ACKNOWLEDGE					.11
SPONTANEOUS					

N=57 $p < .05$* $p < .01$**